mobility during the drift from the initial point of the electrode, we have ascertained that the change of the mobility of positive ions takes place at a definite age i. e., 1×10^{-4} sec.

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5. The Construction of a Mass Spectrometer without the Use of Magnetic Field

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We have constructed a kind of mass spectrometer, without the use of magnetic field, in which the separation of mass of ions was achieved by observing the arrival of short ion pulses of known energy projected through a long drift tube with length L (130cm). When the accelerating voltage of ion pulses is E (300 volts), the velocity of ions is $v=\sqrt{2eE/m}$, and then the time interval between the arrival of pulses of ions with mass m_1 and m_2 at the end of the drift tube will be proportional to $L(\sqrt{m_1}-\sqrt{m_2})$. The apparatus consisted of three parts: ion source, drift tube, and detector.

The ion beam produced at the ion source was interrupted by applying 30 volts to the one of two deflecting plates. When the pulse potential of 100 volts was applied to the another deflecting plate, ion pulses were projected through the drift tube. The ion pulses reached the end of the tube were collected on the first plate of an electron multiplier and the pulses were amplified. These amplified pulses were applied to the vertical plate of a oscilloscope. In our measurement, however, with the residual gas, the pulse size of the oscillograph was very broad. The resolvtion of this instrument generally depends upon the difference of ion energy, which was caused by the initial velocity of ions, different length of ion path, width of ion pulse, and scattering with the residual gas. The dispersion from the different initial energy of ions, Δt_E, is

$$\Delta t_E=\frac{1}{2}\times L\sqrt{m/2eE^3}\times\Delta E=2\times10^{-7}\ \text{sec.}$$

The dispersion from the different length of ion path, Δt_L, is

$$\Delta t_L=\sqrt{m/2eE}\times\Delta L=1.6\times10^{-7}\ \text{sec.}$$

The effect of scattering with residual gas is complicated and is unable to compute exactly. But the order of scattering is as follows:

Pressure of residual gass, N_2.	Percentage of scatted ions.
10^{-4} mmHg	20%
10^{-5} mmHg	3~5%

Our experimental results were in agreement with the above relation.
